

**Remarks**

Claims 2-10, 12-14, 19-23, 25, 26, 28, 29 and 31 are pending in the application.

Claim 31 is rejected under 35 U.S.C. 101 as not falling within one of the four categories of invention.

Claims 9, 19-23, 25 and 28 are rejected under 35 U.S.C. 112, ¶1, as failing to comply with the written description requirement and as failing to comply with the enablement requirement

Claim 9 is rejected under 35 U.S.C. 112, ¶2, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 4, 10 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy et al. (US 2003/0007216, hereinafter Chraplyvy) in view of Hodzic et al. (Hodzic et al: "Improvement of System Performance in N x 40-Gb/s WDM Transmission Using Alternate Polarizations," IEEE Photonics Technology Letters, Vol. 15, No. 1, Jan 2003, pages 153-155, hereinafter Hodzic) and Miyamoto et al. (US 7,116,917, hereinafter Miyamoto '917).

Claims 2-3 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy and Hodzic and Miyamoto '917 as applied to claim 10 above, and in further view of Heismann et al. (Heismann et al: "High-Speed Polarization Scrambler with Adjustable Phase Chirp," IEEE Journal of Selected topic in Quantum Electronics, Vol. 2, No. 2, June 1996, page 311-318, hereinafter Heismann).

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Heismann.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Heismann and Kaplan et al. (US 7,272,271, hereinafter Kaplan).

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto '917 and Kaplan.

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto '917 and Kaplan.

Claim 31 is rejected under 35 U.S.C. 102(b) as being anticipated by Miyamoto et al. (US 2003/0002121, hereinafter Miyamoto).

Each of the various rejections and objections are overcome by amendments that are made to the specification, drawing, and/or claims, as well as, or in the alternative, by various arguments that are presented.

Also, since a dependent claim inherently includes the recitations of the claim or chain of claims from which it depends, it is submitted that the scope and content of any dependent claims that have been herein rewritten in independent form is exactly the same as the scope and content of those claims prior to having been rewritten in independent form. That is, although by convention such rewritten claims are labeled herein as having been "amended," it is submitted that only the format, and not the content, of these claims has been changed. This is true whether a dependent claim has been rewritten to expressly include the limitations of those claims on which it formerly depended or whether an independent claim has been rewritten to include the limitations of claims that previously depended from it. Thus, by such rewriting no equivalent of any subject matter of the original dependent claim is intended to be surrendered. If the Examiner is of a different view, he is respectfully requested to so indicate.

#### **Claim Amendments**

Claims 2-5, 7-8, 9, 10, 12, 19-23, 25, 26 and 28 are amended and claim 31 is cancelled herein. The amendments to independent claims 9, 10, 12, 25, 26 and 28 are discussed below. Claims 19-23 are amended to depend from independent claim 26 instead of independent claim 25. Support is found at least in the Applicants' disclosure at original claim 3. In addition, minor amendments are made to claims 19-20 and 22-23 for clarity. Minor amendments to claims 2-5, 7-8, 12 and 26 are made for clarity. Claim 10 is amended to clarify that the method is for both transmitting and receiving an optical data signal. Support is found in Applicants' specification at least at page 8 line 16 – page 9 line 2.

**Rejection Under 35 U.S.C. 101**

Claim 31 is rejected under 35 U.S.C. 101 as not falling within one of the four categories of invention. Claim 31 is canceled by way of amendment herein. Therefore Applicants submit that the rejection of claim 31 under 35 U.S.C. 101 is now moot.

**Rejection Under 35 U.S.C. 112, ¶1**

Claims 9, 19-23, 25 and 28 are rejected under 35 U.S.C. 112, ¶1, as failing to comply with the written description requirement and as failing to comply with the enablement requirement.

Independent claims 9, 25 and 28 are amended as follows “...phase shift keying ~~between two optical bits separated by an even number of bit periods...~~” The feature “phase shift keying between two optical bits separated by an even number of bit period” was added to claims 9, 25 and 28 by way amendment submitted in Applicants’ response of May 5, 2008. Thus, Applicants submit that by way of such amendment, the rejection of independent claims 9, 25 and 28 under 35 U.S.C. 112 ¶1 is overcome.

In addition, claims 19-23, which previously depended from claim 25 (an optical transmitter for APol-PSK), are amended to depend from claim 26 (an optical transmitter for APol-DPSK). Thus, Applicants submit that the rejection of dependent claims 19-23 under 35 U.S.C. 112 ¶1 is also overcome.

Applicants therefore request that the rejection of claims 9, 19-23, 25 and 28 under 35 U.S.C. §112, ¶1 be withdrawn.

**Rejection Under 35 U.S.C. 112, ¶2**

Claim 9 is rejected under 35 U.S.C. 112, ¶2, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The rejection is traversed.

In addition to the amendment of claim 9 discussed above, claim 9 is further amended in response to the Examiner’s rejection under 35 U.S.C. 112 ¶2. In particular, claim 9 is substantially revised to more clearly recite the series of steps involved in the

method. Applicants therefore submit that claim 9 as amended satisfies the requirements of 35 U.S.C. 112, ¶2. Applicants further submit that by way of such amendment, the scope of the claim remains unchanged and no new matter has been added.

Accordingly, Applicants respectfully request that the rejection of claim 9 under 35 U.S.C. §112, ¶2 be withdrawn.

### **Rejections Under 35 U.S.C. 103(a)**

#### **A. Claims 4, 10 and 29**

Claims 4, 10 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto '917.

With respect to independent claim 10, the Office Action fails to establish a *prima facie* case of obviousness, because Chraplyvy, Hodzic and Miyamoto '917, alone or in any permissible combination, fail to teach or suggest all the claim elements, in particular the feature of demodulating an APol-DPSK signal using an even bit delay line interferometer.

Specifically, independent claim 10 recites:

10. A method for APol-DPSK transmission comprising:
  - modulating an input optical signal according to a precoded electronic data signal by differential phase shift keying between two optical bits separated by an even number of bit periods to generate an encoded optical signal;
  - alternating the polarization of the encoded optical signal using a modulator such that successive optical bits have substantially orthogonal polarizations to generate an APol-DPSK signal; and
  - demodulating the APol-DPSK signal using an even bit delay line interferometer. (emphasis added)

In one embodiment the applications invention is a method for transmitting and receiving an electronic data signal comprising demodulating the APol-DPSK signal using an even bit delay line interferometer. Applicants' specification teaches that in one embodiment an optical-phase shift-keying data modulator is driven by a precoded electronic data signal from a precoder device to produce an optical DPSK signal such that the signal is carried as phase shift keying between two optical bits separated by an even number of bit periods (see Applicants' specification p. 3 lines 13-16) and that the

demodulation of the signal can be achieved by using, for example, an even bit delay line interferometer (see Applicants' specification p. 5 lines 19-20).

The Examiner's attention is directed to the fact that none of the cited references teach or suggest the use of alternate polarization differential phase shift keying (APol-DPSK) as an optical data transmission format and thus *cannot* teach or suggest the feature of demodulating the APol-DPSK signal using an even bit delay line interferometer, as positively recited in independent claim 10.

For example, Chraplyvy teaches using return-to-zero (RZ) pulses with phase shift keying (PSK) or differential phase shift keying (DPSK) as a coding scheme in a high bit-rate long haul dispersion managed optical transmission medium. (See Chraplyvy abstract). Hodzic, on the other hand, teaches only that intensity modulated alternate polarization RZ signals with orthogonal polarization between adjacent bits shows improved transmission quality over general RZ and non-return to zero (NRZ) formats. (See Hodzic p. 153 para. 2). Moreover, and as correctly noted by the Office Action, both Chraplyvy and Hodzic are silent as to the use of a multiple bit delay line interferometer and multiple-bit delay differential data encoding.

Nevertheless, the Office Action asserts that in the combination of Chraplyvy and Hodzic, a two-bit delay interferometer *must* be used to decode the APol-DPSK signal and that Miyamoto '917 teaches this feature. (See Office Action p. 10). Applicants disagree.

In order to combine the advantages of DPSK with alternate polarization, it is not the only solution to differential phase shift key between two optical bits separated by an even number of bit periods and to demodulate the APol-DPSK signal using an even bit delay line interferometer, as taught by Applicants and as claimed in independent claim 10.

Miyamoto '917 teaches generating an RZ intensity modulated signal by using an optical phase modulating unit to encode a DPSK phase modulated signal and converting the phase modulated signal to an RZ intensity modulated signal by an optical filter unit disposed downstream of the optical phase modulating unit. (See Miyamoto '917 abstract and FIG. 17). Applicants note that Miyamoto does not teach or even suggest using an even bit delay line interferometer to demodulate an alternate polarization signal. Thus, Applicants submit that one would have no reason, other than in hindsight based upon Applicants' disclosure, to consult Miyamoto. Furthermore, because there is at least more

than one way to achieve alternate polarization with differential phase shift keying, it is not obvious to modify the alleged combination of Chraplyvy and Hodzic with the teachings of Miyamoto.

For example, Applicants' specification notes that a prior art method for implementing alternate-polarization DPSK uses optical-time-division-multiplexing (OTDM) and polarization-multiplexing in the transmitter and that this approach is impractical for optical networks because it requires multiple optical transmitters for a single channel. (See Applicants' specification p. 2 lines 5-12).

Thus, since the references, alone or in any permissible combination, do not teach or suggest APol-DPSK as a data transmission format, the alleged combination of references Chraplyvy, Hodzic and Miyamoto cannot teach the feature of demodulating the APol-DPSK signal using an even bit delay line interferometer, as positively recited in Applicants' independent claim 10.

At least for the above reasons, Applicants' independent claim 10 is allowable over the cited references under 35 U.S.C. 103. As such, the rejection should be withdrawn.

Since dependent claim 4 depends from independent claim 10 and includes all the same limitations, and as the references cited against claim 10 have been overcome as described hereinabove, such dependent claim is also allowable over the cited references under 35 U.S.C. 103.

Independent claim 29 recites similar relevant limitations to those recited in independent claim 10, in particular "a demodulator comprising an even bit delay line interferometer." As such, for at least the same reasons discussed above, independent claim 29 also is allowable over the cited references under 35 U.S.C. 103(a).

Therefore, Applicants respectfully request that the rejection of claims 4, 10 and 29 be withdrawn.

#### **B. Claims 2-3 and 5-8**

Claims 2-3 and 5-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy, Hodzic and Miyamoto '917 as applied to claim 10 above, and in further view of Heismann.

This ground of rejection applies only to dependent claims and is predicated on the validity of the rejection of claim 10 under 35 U.S.C. 103 given over Chraplyvy in view of Hodzic and Miyamoto '917. Since each such dependent claim includes all the relevant limitations of the respective independent claim from which it ultimately depends, and since the rejection of independent claim 10 has been overcome, as described hereinabove, and there is no argument put forth by the Office Action that Heismann supplies that which is missing from Chraplyvy, Hodzic and Miyamoto to render independent claim 10 obvious, the rejection of the dependent claims likewise cannot be maintained.

As such, claims 2-3 and 5-8 are allowable under 35 U.S.C. 103(a) over the cited references. Thus, Applicants respectfully request that the rejection of dependent claims 2-3 and 5-8 be withdrawn.

### **C. Claims 12-14**

Claims 12-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto, and in further view of Heismann (See Office Action dated October 24, 2008, p. 17). Claims 12-14 also are rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto and in further view of Kaplan. (See Office Action dated October 24, 2008, p. 26).

With respect to independent claim 12, the Office Action fails to establish a *prima facie* case of obviousness, because the combinations of (1) Chraplyvy, Hodzic, Miyamoto and Heismann and (2) Chraplyvy, Hodzic, Miyamoto and Kaplan, alone or in combination, fail to teach or suggest all the claim elements. In particular the references do not teach or suggest modulating an optical signal according to a precoded electronic data signal by differential phase shift keying between two optical bits separated by an even number of bit periods and performing polarization alternating such that successive optical bits have substantially orthogonal polarizations to generate an APol-DPSK signal wherein said modulating and said polarization alternating are performed simultaneously by a Mach-Zehnder modulator including a polarization rotation device in at least one arm, as positively recited in Applicants' independent claim 12.

The teachings of Chraplyvy, Hodzic and Miyamoto are discussed above. As the Office Action acknowledges, Chraplyvy, Hodzic and Miyamoto alone or in combination

do not teach or suggest at least the feature of a single Mach-Zehnder modulator including a polarization rotation device in at least one arm to provide simultaneous polarization alternation and optical data encoding by phase shift keying to generate an APol-DPSK signal. (See Office Action p. 21 and p. 30).

Heismann teaches the advantages of rapid polarization scrambling and sinusoidal phase modulation (chirping) of an NRZ (intensity modulated) signal. (See Heismann p. 311, first paragraph, col. 1-2). The Office Action asserts that Heismann teaches a Mach-Zehnder modulator including a polarization rotation device in at least one arm to provide simultaneous polarization alternation and optical data phase modulation. (See Office Action, p. 21). Applicants disagree.

Heismann does not teach modulating an optical signal according to a precoded electronic data signal by differential phase shift keying between two optical bits separated by an even number of bit periods wherein said modulating and said polarization alternating are performed simultaneously by a Mach-Zehnder modulator including a polarization rotation device in at least one arm. The phase modulating in Heismann is not for the purpose of data encoding but is a sinusoidal modulation (See Heismann, paragraph beginning on p. 312 and ending on p. 313). Thus, Heismann does not teach modulating an optical signal according to a precoded electronic data signal by differential phase shift keying between two optical bits separated by an even number of bit periods wherein said modulating and said polarization alternating are performed simultaneously by a Mach-Zehnder modulator including a polarization rotation device in at least one arm.

As such, the references Chraplyvy, Hodzic, Miyamoto and Heismann, alone or in any permissible combination fail to teach or suggest all elements of independent claim 12 as required to support an obviousness rejection under 35 U.S.C. 103.

Kaplan teaches an optical device using *two* or *four* Mach-Zehnder modulators. (See Kaplan, Abstract and FIGS. 3(a)-3(b) (105 and 106 are *both* Mach-Zehnder modulators, 221 and 222 in FIG. 3(b) are both “quadrature modulators” of FIG. 3(a) and thus, each has two Mach-Zehnder modulators for a total of four). The Office Action asserts that Kaplan teaches a Mach-Zehnder modulator (FIG. 3(a)) including a polarization rotation device (the phase shifter 107) in at least one arm to provide



simultaneous polarization alternation and optical data phase modulation. (See Office Action p. 30). Applicants disagree.

Kaplan FIG. 3(a) is not a Mach-Zehnder modulator, but is a “quadrature modulator” (See Kaplan col. 5 lines 17-30). The quadrature modulator includes a passive Y junction and two Mach-Zehnder modulators 105 and 106. Thus the device 107 is clearly not within one of the arms of a Mach-Zehnder modulator. In addition, the device 107 is not a polarization rotation device, but rather is a phase shifter to obtain a phase difference between the outputs of Mach-Zehnder modulator 105 and 106. Thus, Kaplan does not teach a Mach-Zehnder modulator including a polarization rotation device in at least one arm, as positively recited in Applicants’ independent claim 12.

As such, the references Chraplyvy, Hodzic, Miyamoto and Kaplan, alone or in any permissible combination fail to teach or suggest all elements of independent claim 12 as required to support an obviousness rejection under 35 U.S.C. 103.

At least for the above reasons, Applicants’ independent claim 12 is allowable over the cited references under 35 U.S.C. 103.

Since dependent claims 13 and 14 depend from independent claim 12 and include all the same limitations, and as the references cited against claim 12 have been overcome as described hereinabove, such dependent claims are also allowable over the cited references under 35 U.S.C. 103.

Therefore, Applicants respectfully request that the rejection of claims 12-14 be withdrawn.

#### **D. Claim 26**

Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic, Miyamoto and Heismann. (Office Action p. 22) Claim 26 is also rejected under 35 U.S.C. 103(a) as being unpatentable over Chraplyvy in view of Hodzic and Miyamoto ‘917 and Kaplan. (See Office Action, p. 31).

With respect to independent claim 26, the Office Action fails to establish a *prima facie* case of obviousness, because (1) Chraplyvy, Hodzic, Miyamoto and Heismann and (2) Chraplyvy, Hodzic, Miyamoto and Kaplan, alone or in combination, fail to teach or suggest all the claim elements. In particular the references fail to teach or suggest at least

a Mach-Zehnder (MZ) modulator device optically coupled to an optical source having a half-wave plate in one arm, as positively recited in Applicants' independent claim 26.

The teachings of Chraplyvy, Hodzic, Miyamoto and Heismann are discussed above. The Office Action acknowledges that the alleged combination of Chraplyvy, Hodzic, and Miyamoto does not teach a single Mach-Zehnder modulator device having a half-wave plate in one arm. (See Office Action p. 25). However, the Office Action asserts that Heismann teaches this missing feature, referring to Heismann FIG. 2 90 degree rotated PMF. Applicants disagree. The 90 degree rotated PMF is a "polarization maintaining fiber" (defined in Heismann p. 312 col. 2 second to last paragraph), and is clearly not a half-wave plate. Thus, Heismann fails to teach or suggest a Mach-Zehnder (MZ) modulator device optically coupled to an optical source having a half-wave plate in one arm, as positively recited in Applicants' independent claim 26.

As such, the references Chraplyvy, Hodzic, Miyamoto and Heismann, alone or in any permissible combination fail to teach or suggest all elements of independent claim 26 as required to support an obviousness rejection under 35 U.S.C. 103.

In addition to the foregoing, the Office Action further asserts that Kaplan teaches a Mach-Zehnder modulator having a half-wave plate in one arm, referring to phase shifter 107 in Kaplan FIG. 3(a). Applicants disagree.

The teachings of Chraplyvy, Hodzic, Miyamoto and Kaplan are discussed above. In addition, the Office Action acknowledges that the alleged combination of Chraplyvy, Hodzic, and Miyamoto does not teach a single Mach-Zehnder modulator device having a half-wave plate in one arm. (See Office Action p. 30). Furthermore, as discussed above with respect to the rejection of claims 12-14, the phase shifter 107 in Kaplan is not part of a Mach-Zehnder modulator, but is a separate component. Blocks 105 and 106 in Kaplan FIG. 3(a) are both Mach-Zehnder modulators; phase shifter 107 is clearly described and depicted as a component separate from the Mach-Zehnder modulators 105 and 106. (See Kaplan col. 5 lines 17-30). In addition, the phase shifter 107 is not a half-wave plate. In fact, Kaplan is completely devoid of reference to a half-wave plate.

As such, the references Chraplyvy, Hodzic, Miyamoto and Kaplan, alone or in any permissible combination fail to teach or suggest all elements of independent claim 26 as required to support an obviousness rejection under 35 U.S.C. 103.

At least for the above reasons, Applicants' independent claim 26 is allowable over the cited references under 35 U.S.C. 103. Thus, Applicants respectfully request that the rejection of claims 12-14 be withdrawn.

**Rejection Under 35 U.S.C. 102**

Claim 31 is rejected under 35 U.S.C. 102(b) as being anticipated by Miyamoto. Claim 31 is canceled by way of amendment herein. As such, Applicants submit that the rejection of claim 13 under 35 U.S.C. 102 is now moot.


**Conclusion**

It is respectfully submitted that the Office Action's rejections have been overcome and that this application is now in condition for allowance. Reconsideration and allowance are, therefore, respectfully solicited.

If, however, the Examiner still believes that there are unresolved issues, the Examiner is invited to call Eamon Wall at (732) 530-9404 so that arrangements may be made to discuss and resolve any such issues.

Respectfully submitted,

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